

# PATENT SPECIFICATION

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## (54) HOT MELT COMPOSITIONS BASED ON CROSS LINKED BUTYL RUBBERS

(71) We, EVODE LIMITED, a British Company, of Common Road, Stafford, England, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to hot melt sealant compositions and is a modification or improvement in the invention described in our Patent Specification No. 1 455 251.

Our above patent specification describes hot melt sealant compositions comprising a mixture of a base polymer, a plasticiser and a filler, the base polymer comprising a cross-linked butyl rubber or a blend of a cross-linked butyl rubber with various compatible thermo-plastic polymers, especially ethylene-vinyl acetate copolymers. While the essential component of the base polymer is described as a 'cross-linked' butyl rubber, it will be understood by those skilled in the art that this term is intended to refer to the normal commercially available cross-linked butyl rubbers which are partially cross-linked e.g. with di-vinyl benzene, commonly to an extent of 80% of the theoretical maximum. Such cross-linked butyl rubbers are characterised by being insoluble in solvents in which the substantially non-cross-linked butyl rubber is freely soluble.

The present invention is a modification or improvement of the invention described in our above specification and extends the range of compatible base polymers which have been found to be advantageous in the hot melt sealing composition as well as other modifications in the compositions. It has been found that the blending of the non-cross-linked butyl rubbers and/or ethylene-propylene polymers with the cross-linked butyl rubber reduces the temperature at which the composition is softened and facilitates the compounding of the composition.

According to the present invention there is provided a hot melt sealant composition which comprises a base polymer, a plasticiser and a

filler, the base polymer comprising (a) a cross-linked butyl rubber and (b) an ethylene-propylene polymer and/or a substantially non-cross-linked butyl rubber.

The ethylene-propylene polymer may be a copolymer of ethylene and propylene or a terpolymer of ethylene and propylene and a third comonomer, such as a diene. Normally the third comonomer is present in an amount of 2 to 3% by weight. The ethylene-propylene polymer may be present in the base polymer component of the composition with other compatible polymers in addition to the cross-linked butyl rubber. Preferably, the ethylene-propylene polymer is present in the sealant composition in an amount of up to 25% by weight.

The present invention also includes a method of sealing a gap in a structure which comprises softening a sealant composition as defined above by the application of heat, introducing the softened composition into the gap and cooling or allowing the composition to cool.

As indicated above, the non-cross-linked butyl rubber may partially or wholly replace the ethylene-propylene polymer and preferably does not itself constitute more than 30% by weight of the total composition.

Preferably, the base polymer component of the composition of the invention includes compatible thermoplastic polymers, e.g. acrylic polymers, polyvinyl butyrals, polyamides, atactic polypropylene, ethylene-acrylic copolymers, copolymers of ethylene and ethyl acrylate and copolymers of ethylene and vinyl acetate. Normally, the base polymer components are solid and non-tacky at room temperature, but base polymers can be used which are semi-solids or viscous liquids at room temperature. Where an ethylene-vinyl acetate copolymer is present as an ingredient of the base polymer, it is preferably a copolymer which contains at least 15% of vinyl acetate and has a melt index between 2 and 500.

In common with the composition described

in our patent specification No. 1,455,251, the compositions of the present invention are preferably solvent-free, flexible solids which are substantially non-tacky at room temperature (e.g. 18 to 20°C) and contain the base polymer, plasticiser and filler in the following proportions, by weight:—

	Base polymer	5 to 55%
	Plasticiser	2 to 30%
10	Filler	40 to 70%

In the case where the base polymer includes an ethylene-vinyl acetate copolymer, the EVA copolymer may constitute up to 50% by weight of the composition.

The remaining ingredients of the composition are essentially as described in our above specification both as to their relative proportions of the sealant compositions and

as to examples of typical plasticisers, fillers, moisture scavengers and tackifying resins.

Polybutenes are however particularly preferred as plasticisers in the sealant compositions of the invention especially the liquid forms which, while functioning principally as plasticisers, also constitute to the tackiness of the sealant. It has been found that non-reactive phenolic resins may be used with particular advantage as tackifying resins in the compositions of the present invention as well as in the compositions described in our above mentioned specification. The tackifying resin in the composition is responsible for the initial adhesive grab and also in the long term for the adhesive quality of the sealant during its application lifetime.

The following examples are given to illustrate the invention:

#### Example 1

	Quantity Weight % of total Composition	Chemical Type
40	Raw Materials	
	Polysar XL20	15
	Polysar 301	12
	Hyvis 10	21
45	Icecap K	8
	Carbon black HAF	20
	Staybelite ester 10	15
	Amberol ST 149	7
	Caloxol DAP	2
		Partially cross-linked butyl rubber
		Butyl rubber
		Polybutene
		Clay filler
		Pigment and reinforcing filler
		Rosin ester
		Phenolic resin
		Quicklime dispersion

The words "Caloxol", "Polysar", "Hyvis" and "Staybelite" are Registered Trade Marks.

The above ingredients were mixed in a Z-blade mixer heated to 100°C, by adding the elastomers, plasticiser and tackifying resins and mixing until homogeneous and then adding the remaining ingredients in the order stated and continuing to mix the composition until a homogeneous product was obtained.

This mixing procedure was repeated using the ingredients listed in the following two examples.

#### Example 2

	Quantity Weight % of total Composition	Chemical Type
60	Raw Materials	
	Elvax 410	5
	Polysar XL 20	15
	Indopol H 100	35
65	Clay M 100	38
	Imprez T	5
	Caloxol DAP	2
		EVA copolymer
		Partially cross-linked butyl rubber
		Polybutene
		Clay filler
		Hydrocarbon resin
		Quicklime dispersion

#### Example 3

	Quantity Weight % of total Composition	Chemical Type
70	Raw Materials	
	Vistalon 404	6
	Polysar XL 20	14
	Hyvis 10	36
75	Speswhite	37
	Wing-tack 95	6
	Caloxol DAP	1
		Ethylene propylene rubber
		Partially cross-linked butyl rubber
		Polybutene
		Clay filler
		Synthetic hydrocarbon resin
		Quicklime dispersion

The words "Elvax", "Vistalon", "Wing-tack" and "Imprez" are Registered Trade Marks.

The resultant compositions can be applied by means of a caulking gun after being previously warmed as a cartridge in an oven heated to a temperature sufficient to enable the composition to be readily extruded; in most cases warming in an oven to a temperature in the range of 100—150°C is satisfactory. Alternatively the composition may be extruded in the form of a rope or strip fed into a Hardman type gun in which the rope or strip is heated in a motor driven screw.

WHAT WE CLAIM IS:—

1. A hot melt sealant composition which comprises a base polymer, a plasticiser and a filler, the base polymer comprising (a) a cross-linked butyl rubber and (b) an ethylene-propylene polymer and/or a substantially non-cross-linked butyl rubber.

2. A composition according to claim 1 in which the base polymer includes an ethylene-vinyl acetate copolymer.

3. A composition according to claim 2 in which the ethylene-vinyl acetate copolymer constitutes up to 50% by weight of the composition.

4. A composition according to any one of the preceding claims in which the base polymer includes an ethylene-propylene polymer which constitutes up to 25% by weight of the composition.

5. A composition according to any one of the preceding claims in which the plasticiser is a polybutene.

6. A composition according to any one of the preceding claims in which the base polymer constitutes from 5 to 55% by weight of the composition.

7. A composition according to any one of the preceding claims which additionally contains a tackifying agent.

8. A composition according to claim 7 in which the tackifying agent is a phenolic resin.

9. A hot melt sealant composition substantially as described with reference to the Examples.

10. A method of sealing a gap in a structure which comprises softening a sealant composition as claimed in any one of the preceding claims by application of heat, introducing the softened composition into the gap and cooling or allowing the composition to cool.

11. Sealed structures whenever produced by the method claimed in claim 10.

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